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ABSTRACT

In 1959-61 data were collected from high school students gifted in science. Followup data were collected in 1971-72. In high school, males and females were similar in IQ and intention to pursue science. They differed in math and science standardized test scores, participation in science, and the particular branch of science in which they were interested. Differences in the science area of interest persisted through graduate school, although there were no differences in the proportions of males and females actually in science. Males and females were equally likely to receive a B. A. or a graduate degree but males were more likely to publish in science and to work in science or teaching. (Author)

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A Comparison of Career Development between Males and Females Gifted in Science

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In 1959-61 data were collected from high school students gifted in science. Additional data were collected in 1971-72. In high school males and females were similar in IQ and intention to pursue science. They differed in math and science standardized test scores, participation in science, and the particular science of interest. Differences in the science of interest persisted through graduate school, although there were no differences in the proportions in science. Males and females were equally likely to receive a B.A. or a graduate degree. Males were more likely to publish in science and to work in science or teaching.

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Differences in aptitudes, interests, and activities at the high school level parallel differences between these males and females over the following decade, Females were more likely to chose the biological sciences. They were less likely to complete graduate school or to publish papers in scientific fields.

Several studies (1) have reported that high school males have a greater interest and aptitude in science than high school females. It is also known that females are under-represented in the sciences at the highest educational levels (2). In this study we examine whether these sorts of differences persist in the career development, from high school through graduate school, in a group of males and females for whom there was some control over the factors of ability and interest in science.

The population studied was drawn from a group of students enrolled in the Science Honors Program (SHP) at Columbia University during the period 1959-1962. The SHP is an enrichment program designed to provide experiences in science beyond those of the regular high school curriculum. Selection to the program is a two stage process. High school students are nominated by their schools on the basis of interest and talent. They are subsequently screened on the basis of standardized test scores and interviews. Consequently the program is highly selective. The median IQ in the group was over 135.

The data relating to the high school records of students were obtained from high school transcripts, standardized tests and application forms submitted by the students who were applying to the SHP. Follow-up data were obtained from a questionnaire mailed in 1971 and 1972. This questionnaire was mailed to students, using high school addresses. 38% were returned as non-deliverable. We received replies from 80% of the rest. The percentage of females responding was slightly higher than for males. There was a total of 301 usable responses. Of these, 228 were from males, 73 from females. Although the population studied was selected on the basis of an interest in science and a high aptitude for the subject, even within this group there were substantial differences between males and females. The data on the two groups will be discussed in sequence

of educational program (e.g. first high school, then college, then graduate school, then career data).

At the high school level there were negligible differences in the reported IQ's for the two groups; the male average was 140.4 and the female 140.9. Since IQ scores were obtained from high school records and since a variety of IQ tests were used, no definite inference can be drawn from this data. Although the two groups were comparable on the IQ measure there were differences in scores on standardized tests of math and science achievement. Two different tests were used to measure aptitude. In one year the test was the pre-engineering Aptitude Test. In the other years the STEP tests in math and science were given. The pattern of scores for both tests is the same. Females score significantly lower on tests of math aptitude and science aptitude than do males. The differences in aptitude test scores for math and science are also reflected in interest patterns. 72% of the males reported one or more science related hobbies as contrasted with only 37% of the females ($\chi^2 = 16.83$ $df = 1$ $p < .01$). There were also differences between males and females with respect to science related special awards won while in high school. 85% of the males had won one or more science related awards while 76% of females were similarly honored ($\chi^2 = 12.95$ $df = 1$ $p < .01$).

Males and females did not differ in their intention to major in math or science as opposed to another field ($\chi^2 = 1.36$ $df = 1$ $p > .05$) however the females were more likely to express an intention to major in the biological sciences. 23% of the females and 11% of the males intended to major in a biological science while 85% of the males and 69% of the females expressed an intention to major in the physical sciences or math

($\chi^2 = 7.59$ $df = 1$ $p < .01$). Career intentions were also different for males and females. High school females were more likely to report an intention to work in teaching. These represented 30% of the females and 7% of the males. Males on the other hand, were more likely to intend to work in a math or a science related occupation; 89% for males and 56% for females ($\chi^2 = 15.78$ $df = 2$ $p < .01$).

The males and females are somewhat more similar with respect to school subjects liked least and most. 7% of males and 9% of females reported that math was their least liked subject, while 46% of males and 44% of females said it was the school subject they liked most. Similarly 46% of males and 42% of females reported that science was their favorite school subject while 5% of the females and 4% of the males reported that it was their least liked subject. All of the students in the sample graduated from high school.

Many of the differences and similarities found between males and females in high school are reflected in the college data. For example 73% of the males and 69% of the females actually majored in science or math in college ($\chi^2 = 0.503$ $df = 1$ $p > .05$). Although there is a negligible difference between males and females in their tendency to leave science, there are distinct differences in the science which is their choice. Males as a group tend to major in math and the physical sciences, while females tend to major in biology. In this sample of those who majored in science 28% of the males and 28% of the females majored in math, 59% of the males and 24% of the females majored in a physical science, while 13% of the males and 47% of the females majored in biology ($\chi^2 = 28.78$ $df = 2$ $p < .01$). Reflecting the

differences in college major, was an emphasis on math for males. The males in our sample averaged 23.6 credit hours of math while the females averaged 16.3 hours ($t = 2.67$ $df = 246$ $p < .01$). If success in college is measured by graduation, then there were no differences in the success of males and females. 93% of both males and females report having graduated from college.

A majority of students in the sample went on from college to graduate school. There were negligible differences between males and females in attendance. 91% of the males and 92% of the females reported attendance at a graduate school ($\chi^2 = .01$ $df = 1$ $p > .05$). The proportion of males and females who continued in science is comparable: 66% of the males and 58% of the females did graduate work in a scientific field ($\chi^2 = 1.54$ $df = 1$ $p > .05$). Again, however, the pattern of interests is different. Females are more likely to be in the biological sciences while males are in the physical sciences and math. Of those who continued in the sciences 63% of the females and 26% of the males continued in biology as opposed to math or the physical sciences ($\chi^2 = 18.02$ $df = 1$ $p < .01$).

There were small differences in the extent to which males and females continued on in graduate school to the doctoral level in science. 48% of the males and 37% of the females had received the Ph.D or equivalent degree. This may be related to the fact that females are somewhat more likely to be married. 61% of the males and 76% of the females report having been married ($\chi^2 = 5.40$ $df = 1$ $p < .05$). Moreover, these females tended to marry earlier.

There are only slight differences between males and females in employment patterns. Males are somewhat more likely to report employment

in a science related field or teaching (67%) than females (60%) while females are slightly more likely to report either non-science related employment or else no employment (40%) than males (33%) ($\chi^2 = .99$ $df = 1$ $p > .05$).

There are differences in the extent to which males and females report scholarly publications in science although this difference is not reflected in publications in non-science related areas. In scientific fields 59% of the males and 36% of the females have reported publications ($\chi^2 = 6.32$ $df = 1$ $p < .01$) while in non-science related fields the proportions are comparable, 3[illegible]% of the males and 33% of the females having published ($\chi^2 = .00$ $df = 1$ $p > .05$). Not only are males somewhat more likely to publish, but among those who do publish males tend to publish more papers than females. Males who published, published an average of 3.6 papers while females published an average of 1.7 papers ($t = 1.76$ $df = 121$ $p < .05$).

In the years since the time our original data were collected (1959-61) there has been a considerable change in the attention given to providing opportunities for women to pursue careers in fields previously dominated by men. One might expect this emphasis to be reflected in the characteristics of the current group of SIP students. It is not. In the 1959-61 period, 21% of the participants were female. In the current program (1972-73) the figure is the same. When the 1959-61 students were tested in science and math, males scored significantly higher than females on each test. This difference persists in the tests given to applicants to the current program. Males scored higher than females in math ($t = 2.08$ $df = 477$ $p < .01$) and in science ($t = 2.69$ $df = 477$ $p < .01$). In the

summer of 1972 students ranked the areas in which they wished to take SHP courses. The pattern of first choices resembles that of the SHP students a decade earlier. 29% of those choosing a biological science were female. Only 15% of those choosing a physical science or mathematics were female ($\chi^2 = 6.06$ $d.f. = 1$ $p < .05$). Even in a highly select group there are distinct male-female differences which persist.

References and Notes

1. See, for example, Walter S. Monroe, Ed., Encyclopedia of Educational Research, rev. ed., (MacMillan Co., New York, 1950), pp. 1205-1208. A recent study supporting these results with high ability students is by D. Keating and J. Stanley, Ed. Res., 1, 3 (1972).

2. U.S. Office of Education, Doctor's Degrees Conferred by All U.S. Institutions: by State, Academic Field, Sex, and Institution, 1960-61 Through 1969-70 (Government Printing Office, Washington, D.C., 1972).